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Road Traffic Conflict, A Case Study Of University Of Benin (Nigeria) Main Gate T-Junction

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***Abstract*—Traffic conflict approach is a suitable means to conduct a study of traffic safety. The present aims to conduct such study at University of Benin main-gate based on this approach. Surveys conducted include identification and classification of traffic conflict, volume data at the intersection. One way Anova was used to analyze the difference in the volumes of traffic at all locations and shows that there were no significant difference in the volumes of traffic except on holiday's period where the difference was clearly seen. Developed models show that linear relationships are significantly appropriate to explain the relation between traffic conflict and traffic volume with coefficient of determination ranging between 0.47 and 0.76. Cross merge and merge-merge actuated conflicts were reduced after temporal installment of drums to stop commercial drivers from packing at the intersection. In order to enhance traffic safety the study proposes suitable counter measures such as marking the minor road, providing signs and signals legible enough for operators, zebra crossing, and effective control of commercial driver.**

Keywords—Traffic, Conflict, intersection, operators, zebra crossing.

Introduction

A road traffic conflict, is "an observable event which would end in an accident unless one of the involved parties slows down, changes lanes, or accelerates to avoid collision. Traffic conflicts are defined by their time-to-collision, post-encroachment-time, and angle of conflict parameters as well as the vehicles' position in time and space (Rise, 1995)

Traffic safety is commonly measured in terms of the number of traffic accidents and the consequences of these accidents in terms of severity. While this historical data approach is useful for the identification of safety problems, it is regarded as a 'reactive' approach implying that a significant number of accidents must be recorded before a decision could be taken (Katamin *et al*, 1998). A further drawback with this approach concerns the quality and availability of accident data. In order to perform a different form of safety analysis, the use of Surrogate Measures of safety has been suggested as an alternative to accident data analysis (Tiwari *et a*l, 1998).

Road traffic conflicts can be used to estimate the probability of accident occurrence, assess road safety, or evaluate road safety programs if the relationship between road traffic accidents and conflicts is known. To this end, we propose a model for the relationship between road traffic accidents and conflicts recorded by drive recorders (DRs) (Guangquan Lu *et al*, 2011)

The Traffic Conflict Technique (TCT) is perhaps the most developed indirect method of safety surrogate measure. The technique itself is grounded in the ability to register the occurrence of near accidents directly in real-time traffic and therefore, offers a faster and, in many aspects, more representative way of estimating expected accident frequency and accident outcomes. The concept of traffic conflicts was first introduced in 1968 during the meeting of International Cooperation on Theories and Concepts in Traffic Safety in Oslo, as: "A traffic conflict is an observable situation in which two or more road users approach each other in space and time to such an extent that there is risk of collision if their movements remain unchanged (Shbeeb, 2000). The primary advantage of TCT is that conflicts occurred much more frequently than accidents. The conflict method provided a clearer picture of the initial causes of the accidents, something often lacking from accident reports. Furthermore TCT may provide information on relative risks to diagnose the types of problems at a particular location, and it represents an easy and efficient tool to check location safety issues when there is limited or no crash data.

A traffic conflict survey is a systematic method of observing and recording traffic conflicts and other events associated with safety and operations. Traffic conflicts are measures of accident potentials and operational problems at a highway location. Over the years various bodies have utilized various forms of conflict data to assist in its efforts for highway improvement. The first formalized procedure for identifying and recording traffic conflicts at intersections was developed by Perkins and Harris of general Motors Corporation in 1967. Major types of conflicts at intersections include weave, pedestrian cross-merge and merge-merge conflicts. This report critically evaluates the traffic conflict technique in an attempt to resolve the safety deficiencies at University of Benin main-gate. Based on the positive results of a large investigative study by the federal highway administration FHWA, reported by Baker in 1971, the TCT has gained popularity as an evaluative tool. The Washington State Department of Highways is using the TCT as a diagnostic tool to determine appropriate countermeasures at high accident locations. Conflict counts may be used to quickly evaluate changes in road design, signing, signalization, and environment. Crude forms of traffic conflict counts have been made since traffic engineers first began making field observations to determine appropriate safety improvements.

Our traffic environment is getting more and more complex. Pedestrian crossing is haphazard, commercial vehicle stopping to drop and carry passengers in an unorganized manner causing a lot of obstruction to other road users especially University of Benin cab operators. Wider roads and better technology also means higher speeds. Motorists want short travel times. At the same time, vulnerable road users such as bicyclists, pedestrians, and elderly drivers, demand increased safety as well as less obstruction. It is usually a very difficult task for pedestrian to cross the major road as the road design do not carter for them. How are these demands to be met? How can the traffic environment be designed to make everybody happy? In the daily work of improving the traffic environment, it is important to pin point which places and or situations that are dangerous, and why they are dangerous as well as assessing whether a modification is beneficial. The conflict technique enables us to study hazards in traffic in an uncomplicated way. It used to be a number of reported accidents at a site that decide whether it should be rebuilt or not. Now, we can judge whether the site is dangerous after only a period of conflict study, and if so, propose suitable countermeasure.

The conflict technique emanates from research originally at the Detroit General Motors Laboratory in the late 1960's for identifying safety problems related to vehicle construction (Perkins & Harris, 1968). The use of this technique soon spread to different parts of the world. TRL in England soon recognized the need to add a subjective scale for observed conflicts as a measure of severity (Spicer, 1973). This technique was based on observer judgments using time-lapse filming, thereby proving costly and time-consuming. The Swedish Traffic Conflict Technique (STCT) was developed at LTH in different projects during the 1970's and 1980's before finally reaching its present day level of development (Hyden, 1987). The Swedish technique focuses on situations where two road-users would have collided had neither of them made any kind of aversive maneuver. The point at which the aversive action is taken is recorded through observation as the "Time-to-Accident"(TA). The TA value together with the conflicting speed is used to determine whether or not a conflict is "serious".

Usability, Reliability and Validity

While the interest for the conflict technique has been considerable, its practical use has been limited due to questions concerning reliability and validity and the relative costs involved with data collection (Hauer, 1978). The Swedish technique is by far the most commonly used technique for research purposes, and is recognized in many countries all over the world.

Questions concerning reliability are related to the subjective element in the registration process where trained observed judge speed and distance. Tests have shown rates of up to 80 per cent agreement between different observers. Questions concerning validity focus on whether or not the technique is an accurate proximal measure of accident occurrence. Also, product (predictive) validity concerns the relationship between serious conflicts and the numbers of accidents. Tawari *et al*, (1998) showed that normal conflict studies could produce estimates of average accident frequency that were at least as accurate as those based on historical accident data, and Svensson (1992) concluded from Swedish data that serious conflicts provide a better estimate of the number of expected accidents involving personal injury. The results of studies in many different countries have also been compared to show that the relative statistics for conflicts and accidents are in agreement despite environmental differences.

Another major concern is process validity, i.e. whether the processes that determine conflicts are also the same as those that determine accidents. Hyden (1987) concluded, on the basis of data relating to TA and speed values, that conflicts and accidents did in fact share the same severity distribution, and that accidents generally had a 0.5 sec lower , TA-value and speeds of up to 10-20 kph than those found in serious conflicts.

State-of-the-Art

A thorough search in the Ingent, a database covering a wide range of different journals in the fields of engineering technology, transportation, social sciences and social and public welfare (e.g. Accident Analysis and Prevention, and Transportation Research) provided surprisingly little information. Only four published articles of any interest were found which directly indicate the use of the traffic conflict technique. The reason for this poor result may perhaps lie in the fact that, although many studies employ the conflict technique as part of their safety evaluation strategy, few consider it important enough to include in the title or abstract. A similarly unfortunate search was also made on the Traffic Psychology section of the Psych Info database.

Safety Indicator and Micro-Simulation

It is evident that traffic safety analyses with microscopic traffic simulation have a number of restrictions. Most importantly, driver behaviour in real road traffic is more diverse and less predictable than can be implemented within any model whatever the level of detail. Normal microscopic simulation models are developed for e.g. traffic-flow analyses, and require far less consideration to driver behaviour and error modelling than that essential for safety analyses. There is also little or no lateral vehicle movement. However, despite these and various other limitations it is believed that this type of simulation can give valuable insights into the relative safety impacts brought about by changes of traffic flow, various ITS devices placed inside the vehicle or on the roadway, different signaling strategies, and many other dependent aspects. Measuring safety indicators such as TA, and TTC that emanate from the microscopic simulation of vehicle dynamics and driver behaviour (including the probability of errors) in the traffic environment is an essential part of the SINDI project.

A Case Study of Pedestrian Traffic Conflict Technique

Although the improvement of conditions for pedestrian movement is a key objective of planning for mobility (Parker and Zeeger, 1989), in the design of transport systems pedestrians are often overlooked (Zegeer and Deen, 2004), with serious consequences for safety. In 2006, more than 3.500 pedestrians died from road traffic accidents in 14 European countries. This corresponds to more than 14% of road traffic fatalities in these countries.

Although largely developed in the case of conflicts between vehicles, TeT presents some gaps or lacks when vulnerable users, like pedestrian, act a role in the conflict. In literature, existing applications report some attempts to define spatial or temporal index to classify the severity of vehicle-pedestrian conflict.

Among these, it can be mentioned the Time to Collision (TTC), the time, in different phases of conflict, should occur for a vehicle to collide with another road user, if relative speed and remain invariant (Al-Kubaisy, 2002).

When there is a conflict, the value of TTC varies over time, therefore a proper evaluation requires a continuous monitoring with the identification of the critical value (e.g. minimum). The Time to Zebra (TTZ) was proposed as a variation of the concept of Time to Collision developed in order to estimate frequency and severity of the critical situation between the vehicles that are approaching the pedestrian crossing and the pedestrians who are crossing it. TTZ is determined at the start instant of the conflict that has to be identified by the observer.

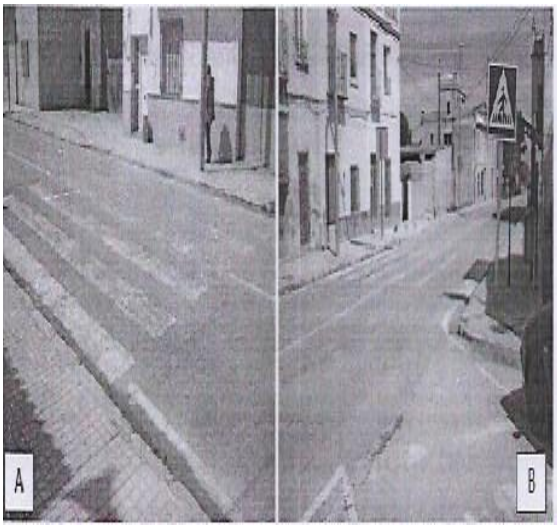

Fig 1: Crosswalk in the first scenario

Methodology

Data Collection

Traffic conflict and volume data were collected manually at University Benin main gate. The procedure involves counting the vehicles and conflicts for each approach; this was done at the same time. The daily collection was divided into two sections, morning peak from 7am to 9am and afternoon peak from 3pm to 5pm. Four observers were positioned in different location for the morning and afternoon peak hour each.

The survey was conducted during a 6week observation period from Monday to Friday to ensure reliable data. The conflict and volume count was carried out for two hours at each approach, the traffic conflict and volume data are then compiled for subsequent analysis using the Statistical package for the social science. (SPSS 17).

1. Vehicles entering University of Benin
2. Vehicles not entering University of Benin
3. Vehicles out from University of Benin
4. Vehicles making U-turn
5. Vehicles going from Benin to Oluku town

Analysis of Data

Analysis of Traffic Conflict

Classification of conflict type according to weeks:

The different types of conflicts reported in each week for the 6 weeks shows that there are significant difference between the mean and the post hoc test shows the day(s) of the week that cause the difference.

Classification According to Type

Here the conflict types are separately analyzed week by week for the 6weeks. It can be seen that the mean difference is significant at 0.05 level for weave conflict, cross-merge and merge-merge conflict. While for pedestrian conflict, there are no significant difference between the means for both morning and afternoon period.

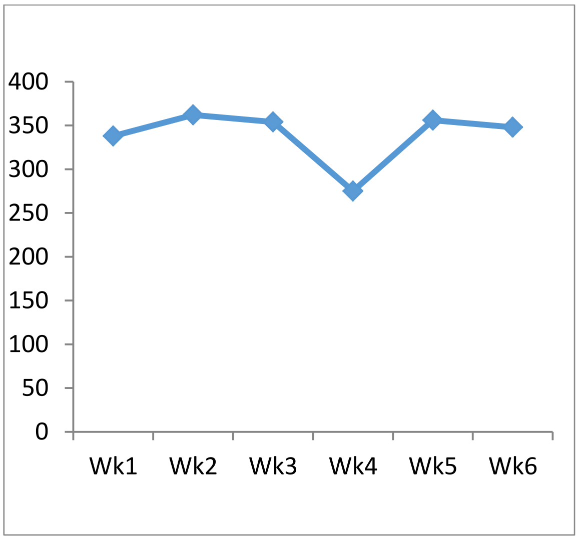

Fig 2: Total conflict in the peak of afternoon for 6weeks

As shown in the graph above, the total conflict in the afternoon peak is higher for the first two weeks which explain the impact of other environmental factors in the site like bus drivers packing wrongly to drop and carry passengers at the intersection and by the third week a temporal countermeasure was provided which reduced the conflict.

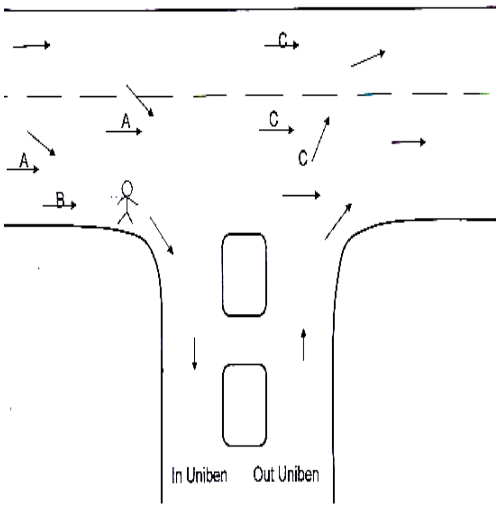

Fig 3: Traffic flow at University Benin main-gate

Types of Conflict

The major type of conflict observed at the university of Benin main-gate are:

a. Weave conflict: Lane changing and turning from wrong lane.

b. Pedestrian conflict

c. Cross-merge and merge-merge conflict

Relationship between traffic conflict and traffic volume

Most of related literatures show that traffic conflict have a positive association with traffic volume. The graph demonstrates a summary of key finding about the relationship between traffic conflict and traffic volume.

On the other hand, some statistical models were developed to relate conflicts and traffic volumes as follows:

The total traffic volume is significantly correlated with total conflict and the coefficient of determination for the morning and afternoon period is between 0.47 and 0.76.

The model developed to explain the relationship between total conflict and traffic volume at University of Benin main-gate is as follows:

$Y = 0.04x - 634.96$ for morning and

$Y = 716.77 - 0.01337x$ for afternoon.

$Y = total\ conflicts\ per\ 2hours,$

$X = total\ volume\ per\ 2hours.$

As shown in the graph the total conflict in the afternoon peak is higher for the first two weeks which explain the impact of other environmental factors in the site like bus drivers packing wrongly to drop and carry passengers at the intersection and by the third week a temporal countermeasure was provided which drastically reduced the conflict.

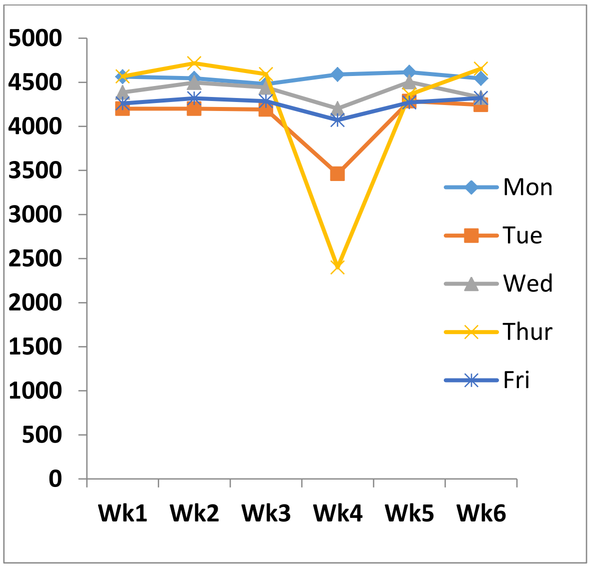

Fig 4: Shows the reduction in volume on Tuesday and Thursday due to public holidays

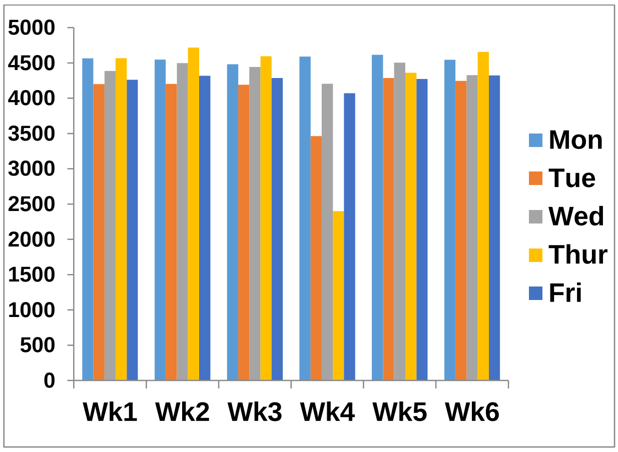

Fig 5: Total conflict for morning and afternoon peak

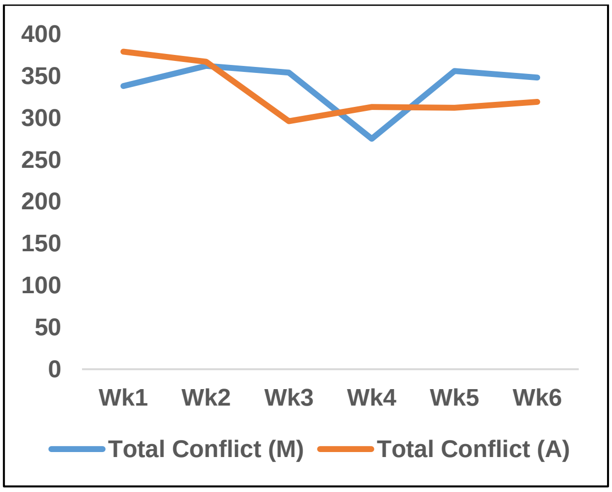

Fig 6: Total weekly conflict.

Conclusion

The traditional road accident statistics were used to assess the level of road safety and to evaluate road safety programme. The application of modern traffic conflicts parameter which relies on observation of critical traffic situation were used to overcome the safety challenges in and around the University of Benin, (Nigeria) main entrance gate. The use of these parameters brought about ease of traffic flow for the cab operators, pedestrians and other road users. This research work has given a facelift to the University community.

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